Boeing Technology
Phantom Works

Mobile Communication Network Architecture (MCNA) Overview for ICNS 2005

Co-Funded by FAA and NASA GRC under the Boeing Global Communication, Navigation and Surveillance System (GCNSS) Follow-on Contract

Boeing team includes: Boeing, Avaliant, Honeywell & ITT

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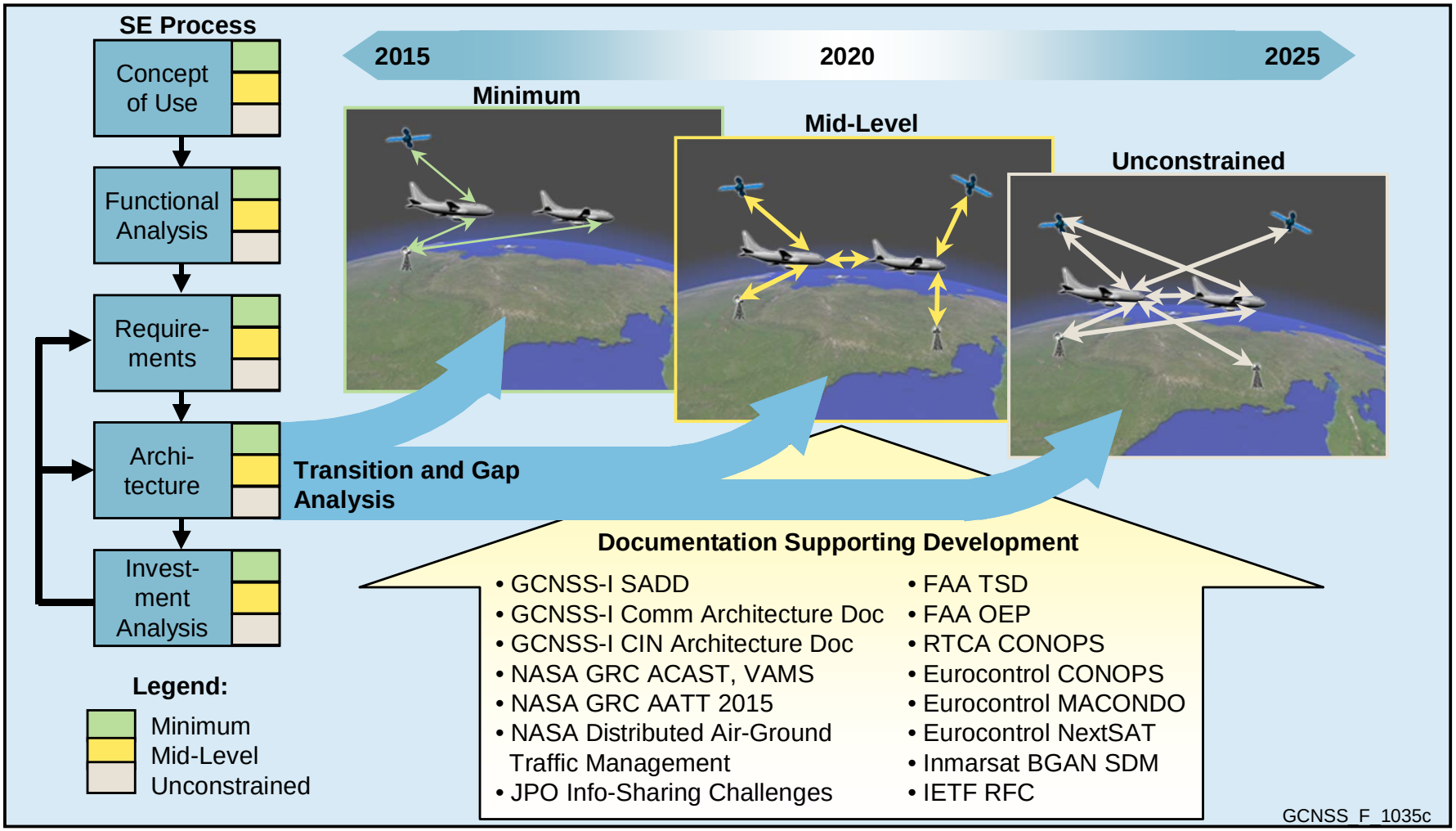
MCNA Introduction

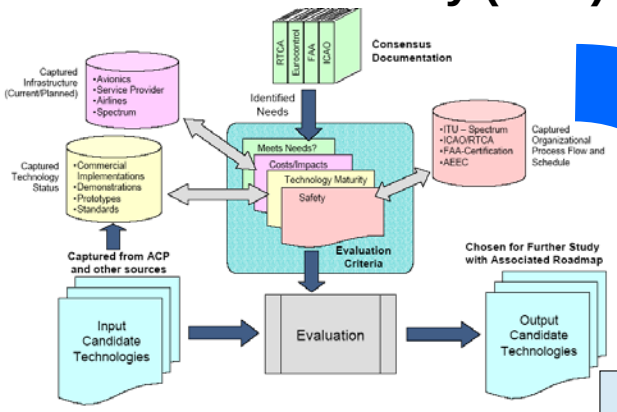
- **Mobile Communication Network Architecture (MCNA) represents the aggregate of all digital voice and data communications for CNS/ATM**
- **Specifically focused on communication support for Network Centric Operations**
- **System of System Engineering (SoSE) approach**
- **Results will provide a technology development roadmap to help guide future NASA GRC R&D efforts**
- **Contract focused on covering breadth vs. depth during this phase**

MCNA SoSE Approach

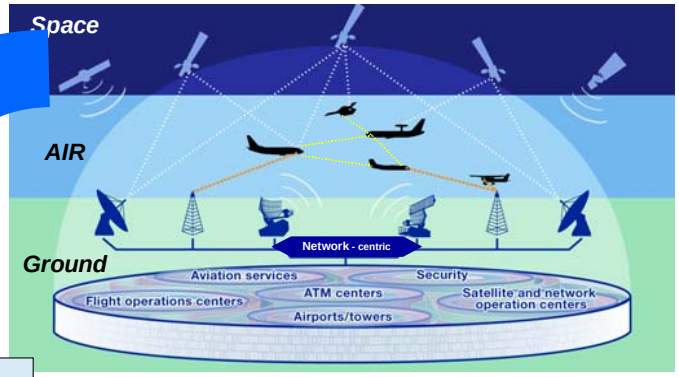


MCNA Relationship with Past, Present & Future NASA Research Activities

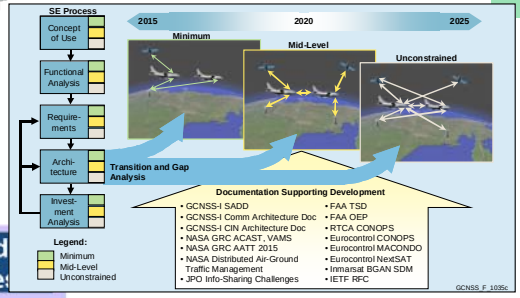
Future Comm. Study (FCS)



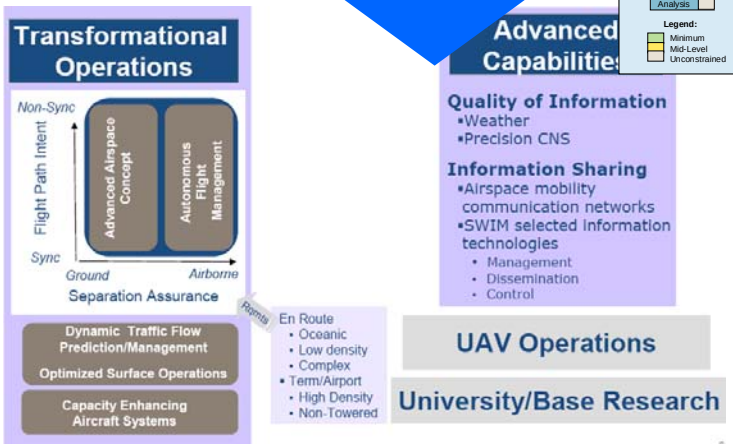
GCNSS I



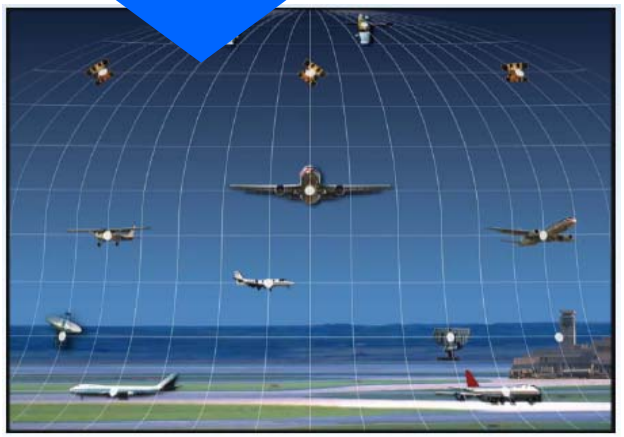
MCNA



TNAS 2015-2025



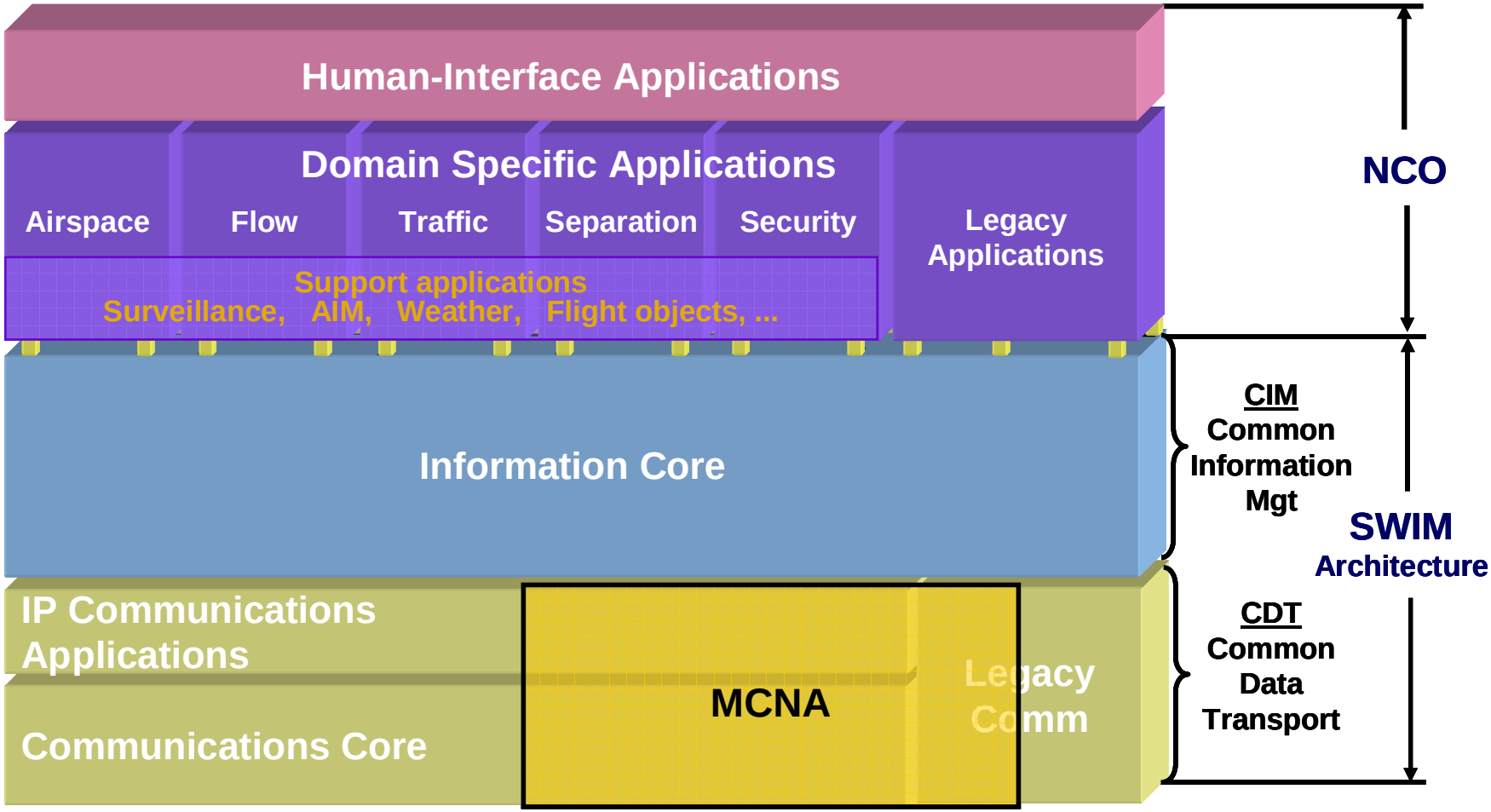
ACAST 2007-2015



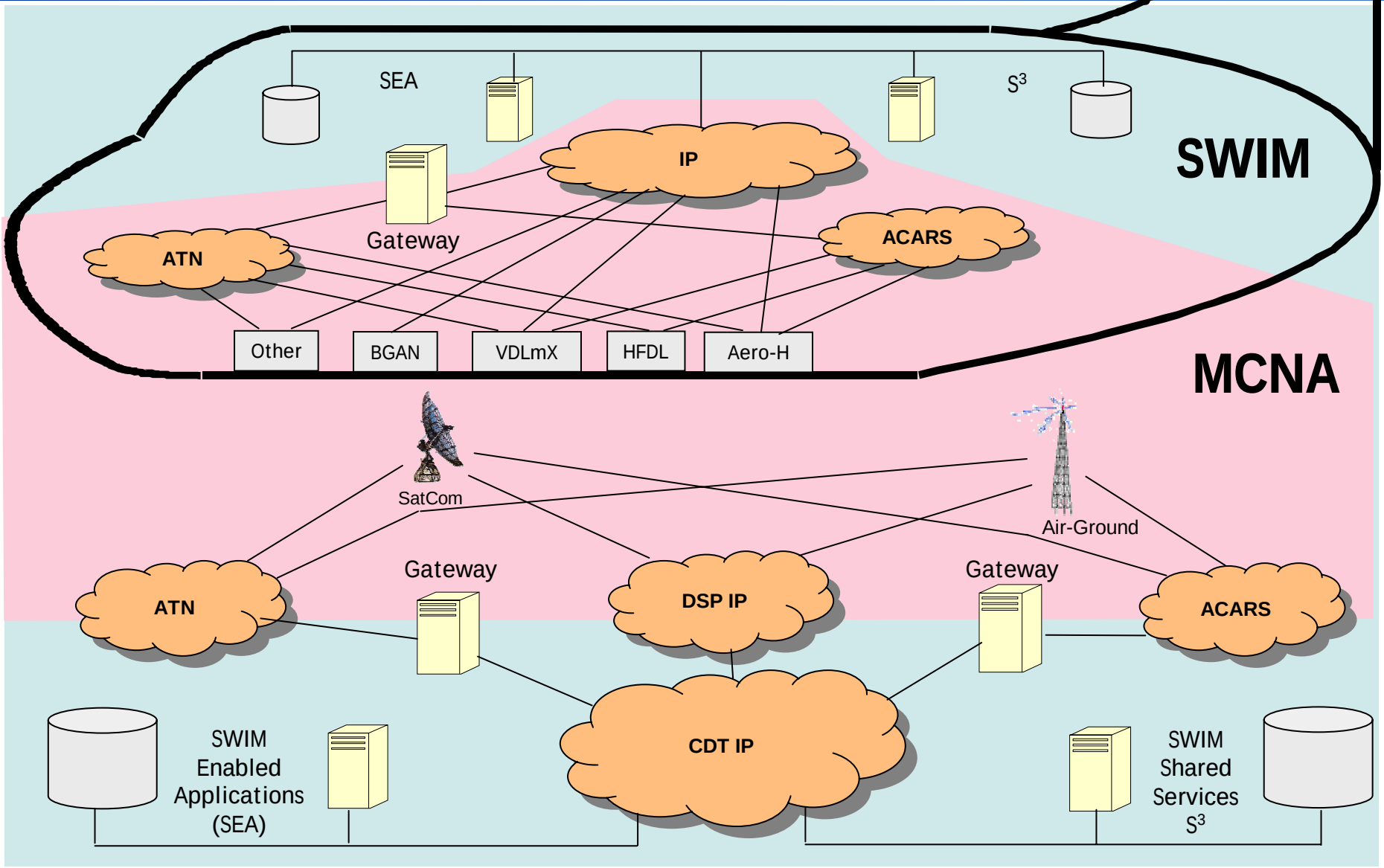
MCNA and SWIM

- **MCNA will eventually become an extension of the Common Data Transport (CDT)**
  - **Extends SWIM to the aircraft**
- **Initial focus on datalink transition**
  - **Timelines for avionics upgrades**
  - **Coordination with ground infrastructure and procedures**
- **Early implementations of SWIM mobility may employ gateways/brokers on the aircraft and the ground**
  - **Store and distribute static SWIM information**
  - **Provide common information and communication interface to new applications on the aircraft**
- **As MCNA capabilities expand, certain aspects of SWIM may be extended directly to the aircraft**
  - **Real time collection and distribution of dynamic information**

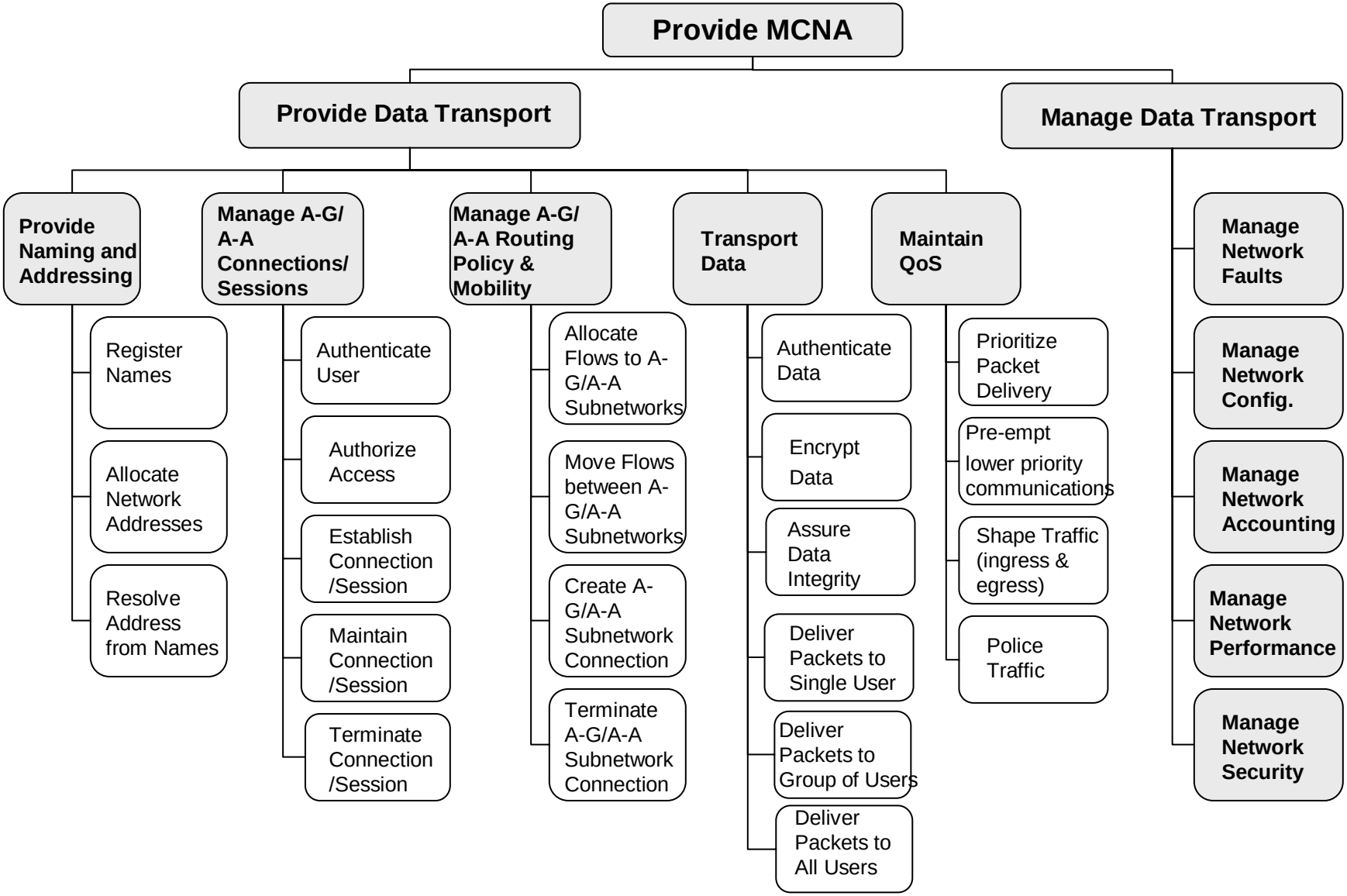
MCNA Relationship with CDT, CIM and SWIM



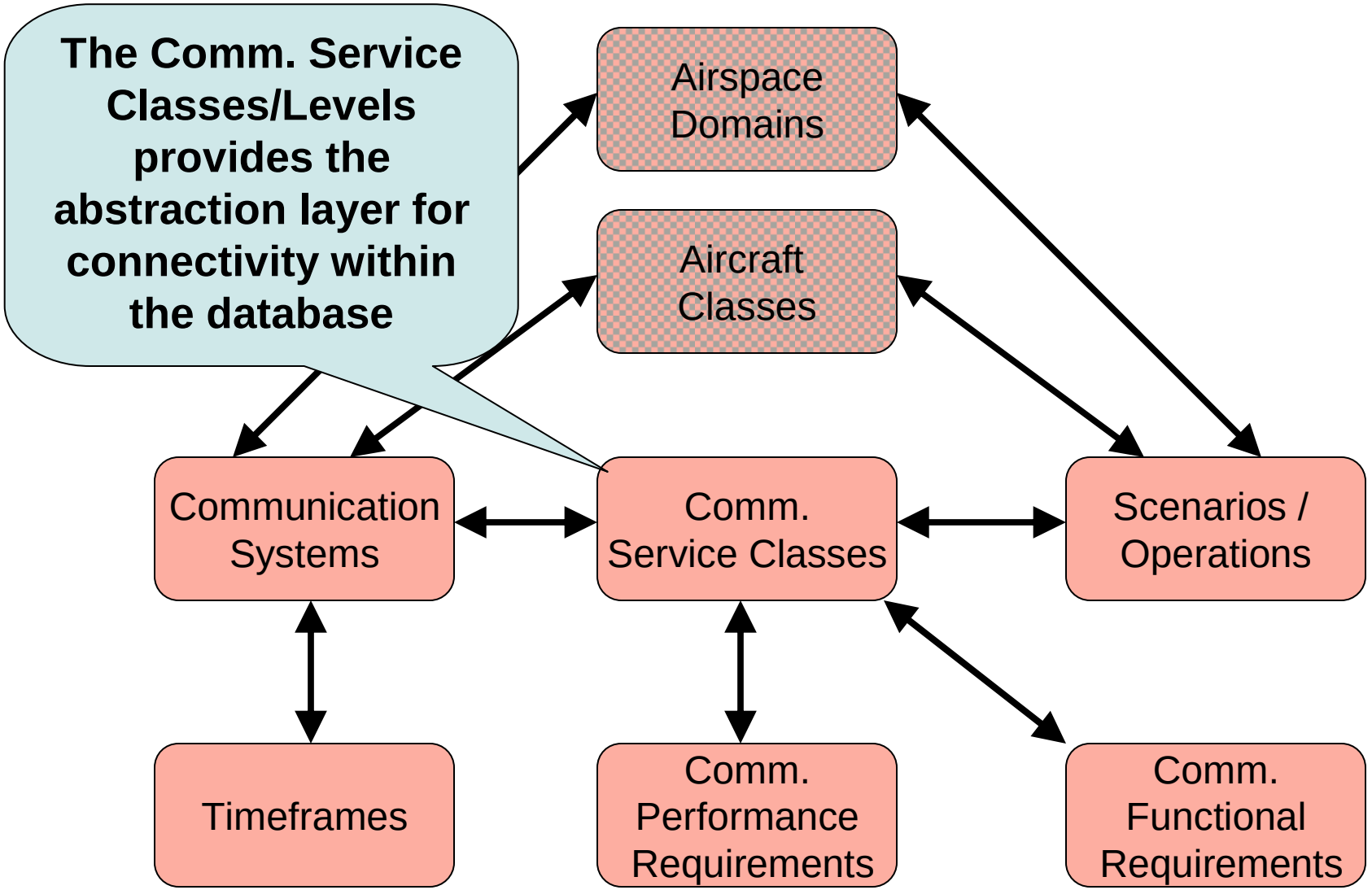
MCNA Context



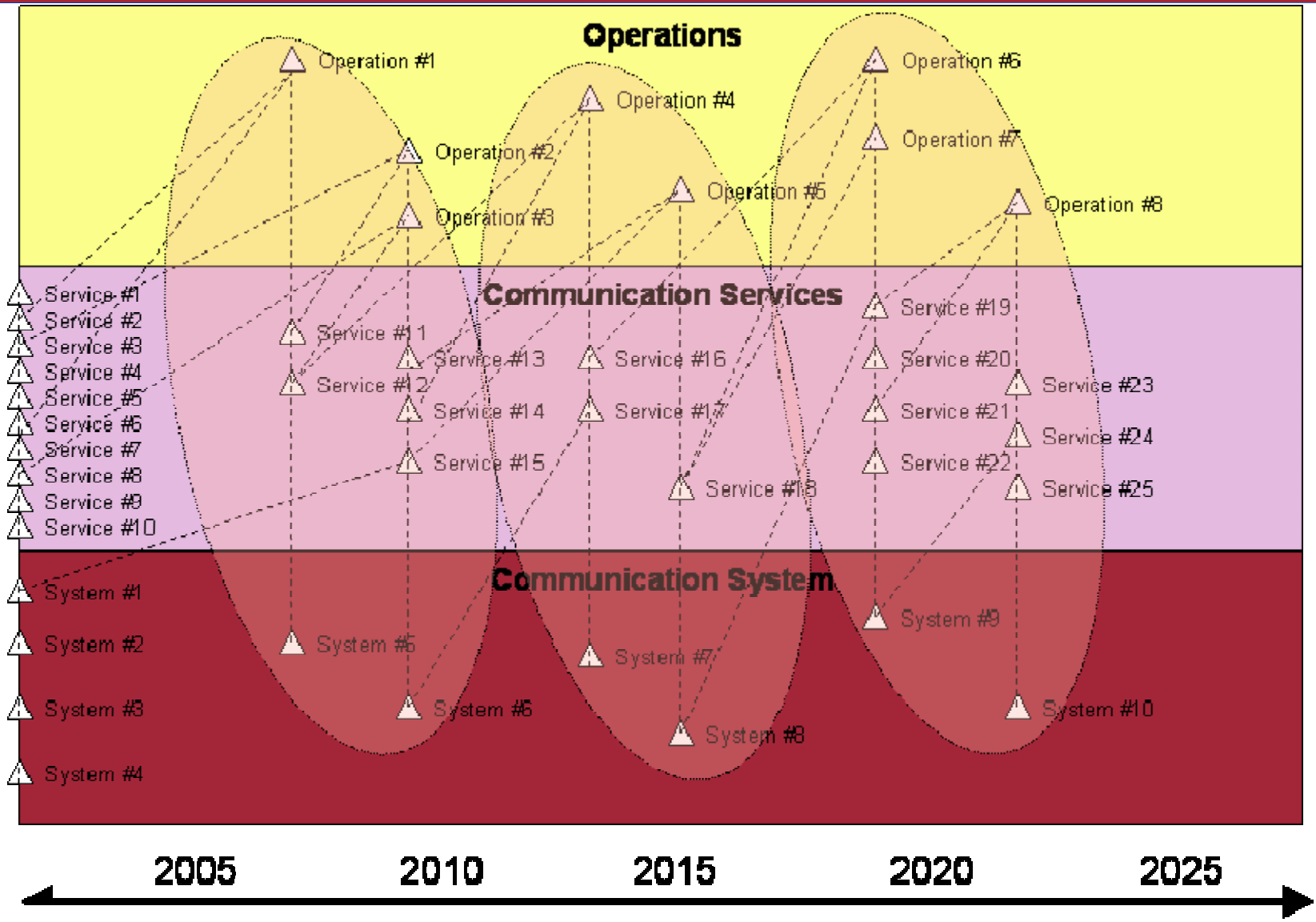
MCNA Functional Architecture



MCNA SoSE Relational Database



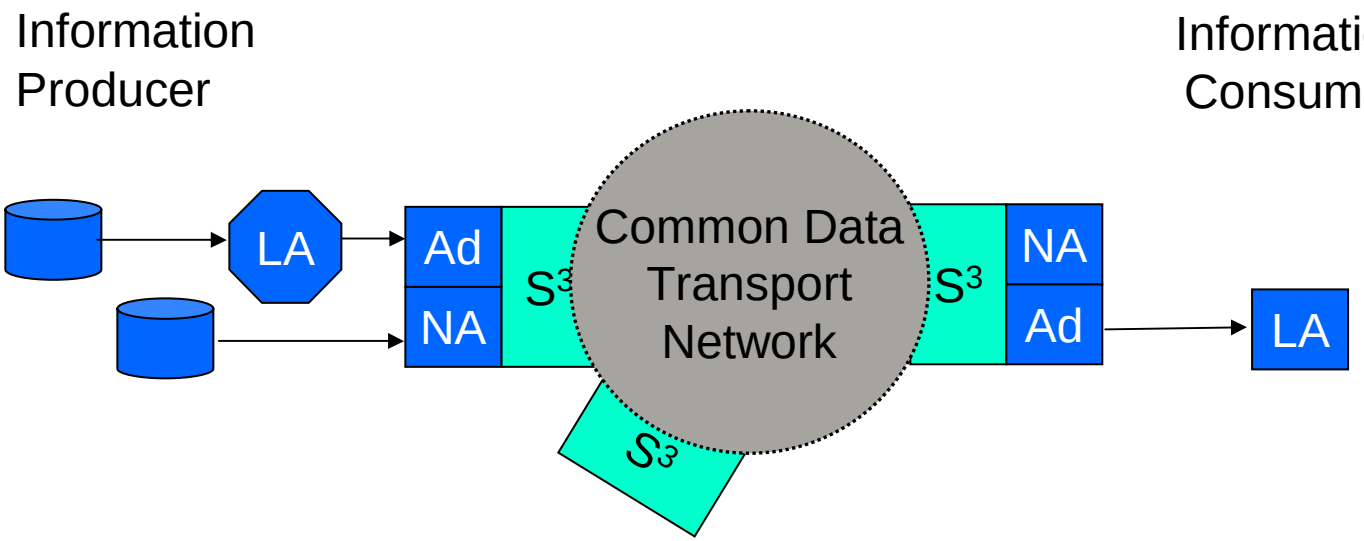
Notional MCNA Transition Plan



Ongoing Usage of the Relational Database

- **The initial rendering of this MCNA database will be most useful to demonstrate general trends.**
  - **Fidelity of the inputs will be too low after the first cut to draw many specific conclusion**
- **The true value of the database will be as a tool to support ongoing MCNA R&D**
  - **Define which services are required by envisioned scenarios**
  - **Define which services will be supported by planned systems**
  - **Define what requirements new systems should support**
  - **Determine impacts of delays in system deployment schedules**
  - **Conduct cost/benefit optimization of deployment sequences**
  - **Determine "need by" dates of system and avionics deployments to meet anticipated operations deployment schedules**
  - **Evaluate the viability and timing of new operational concepts**

SWIM Node Reference Model



SWIM Element

Applications Element

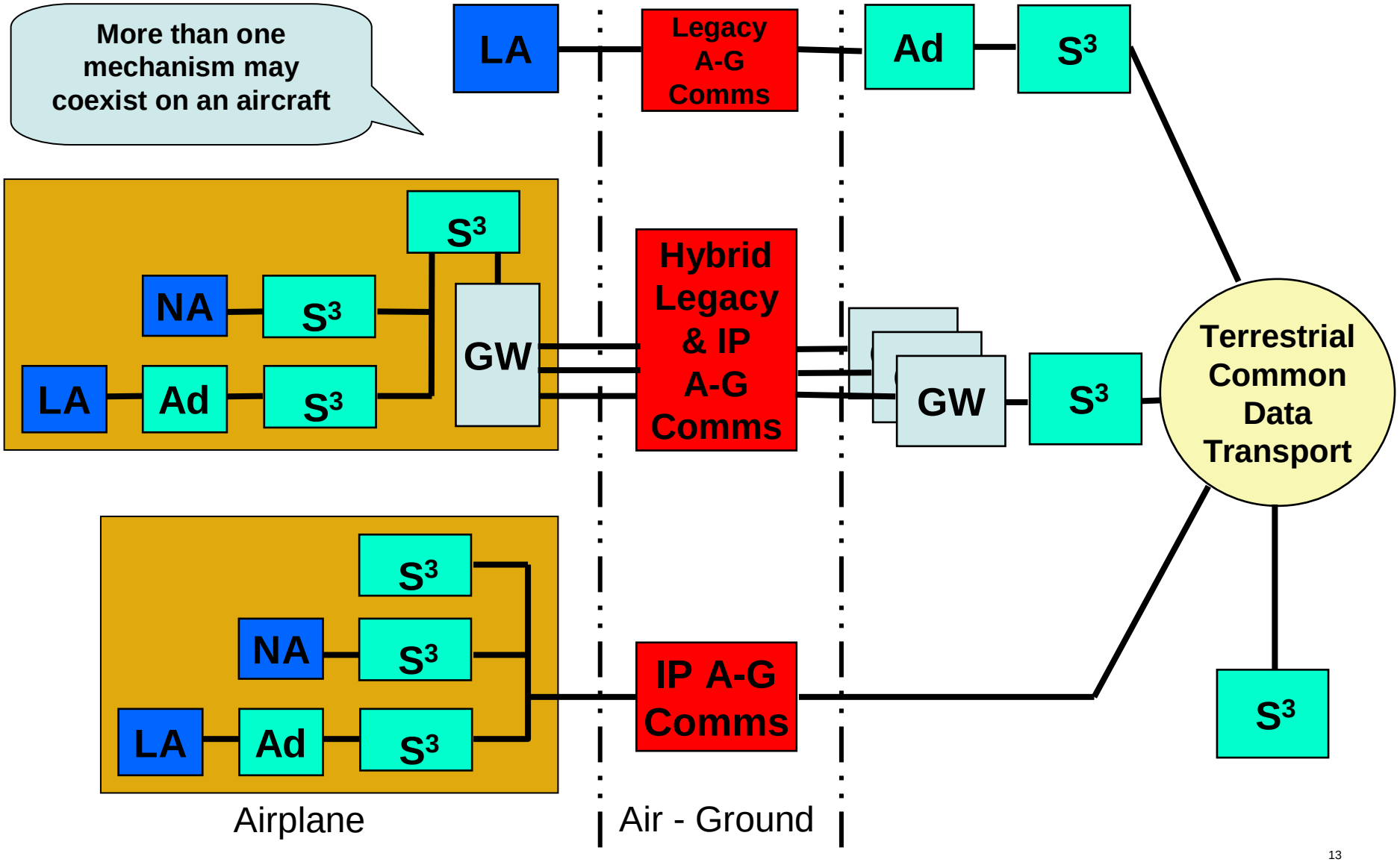
S^3 – SWIM Shared Services

NA – Native Application

LA – Legacy Application

Ad – Adapter

MCNA/SWIM Nodes – Implementation Options



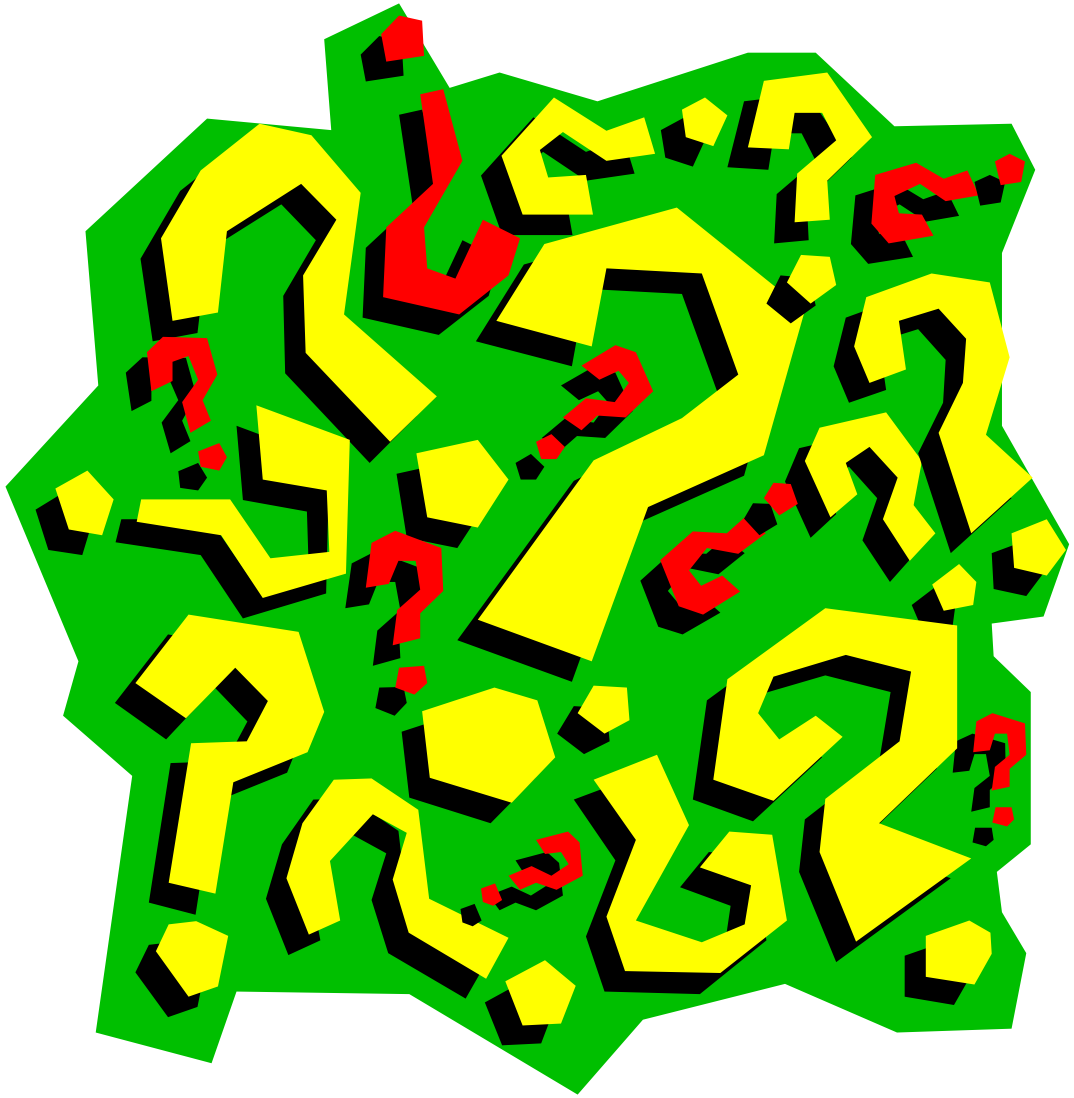
MCNA Deliverables & Status

CDRL	Name	Primary Focus	Approx. Pages	Initial	Final
A040	MCNA Architecture Report	Avaliant	100	3/10/2005	5/27/2005
A041	Technology Roadmap	ITT/ Honeywell	25	NA	6/10/2005
A042	Transition & Interoperability Plan	Avaliant	50	4/1/2005	6/10/2005
A043	Simulation, Emulation, and Demonstration Plan	ITT	50	3/10/2005	5/27/2005
A044	MCNA Investment Analysis	Boeing	30	10/29/2004 (Plan)	6/15/2005
A045	MCNA Final Report	Avaliant	25	6/30/2005	7/15/2005
A046	MCNA Requirement Report	Avaliant	75	12/15/2004	5/20/2005
A047	Certification Plan	Honeywell	40	NA	6/10/2005

MCNA Summary

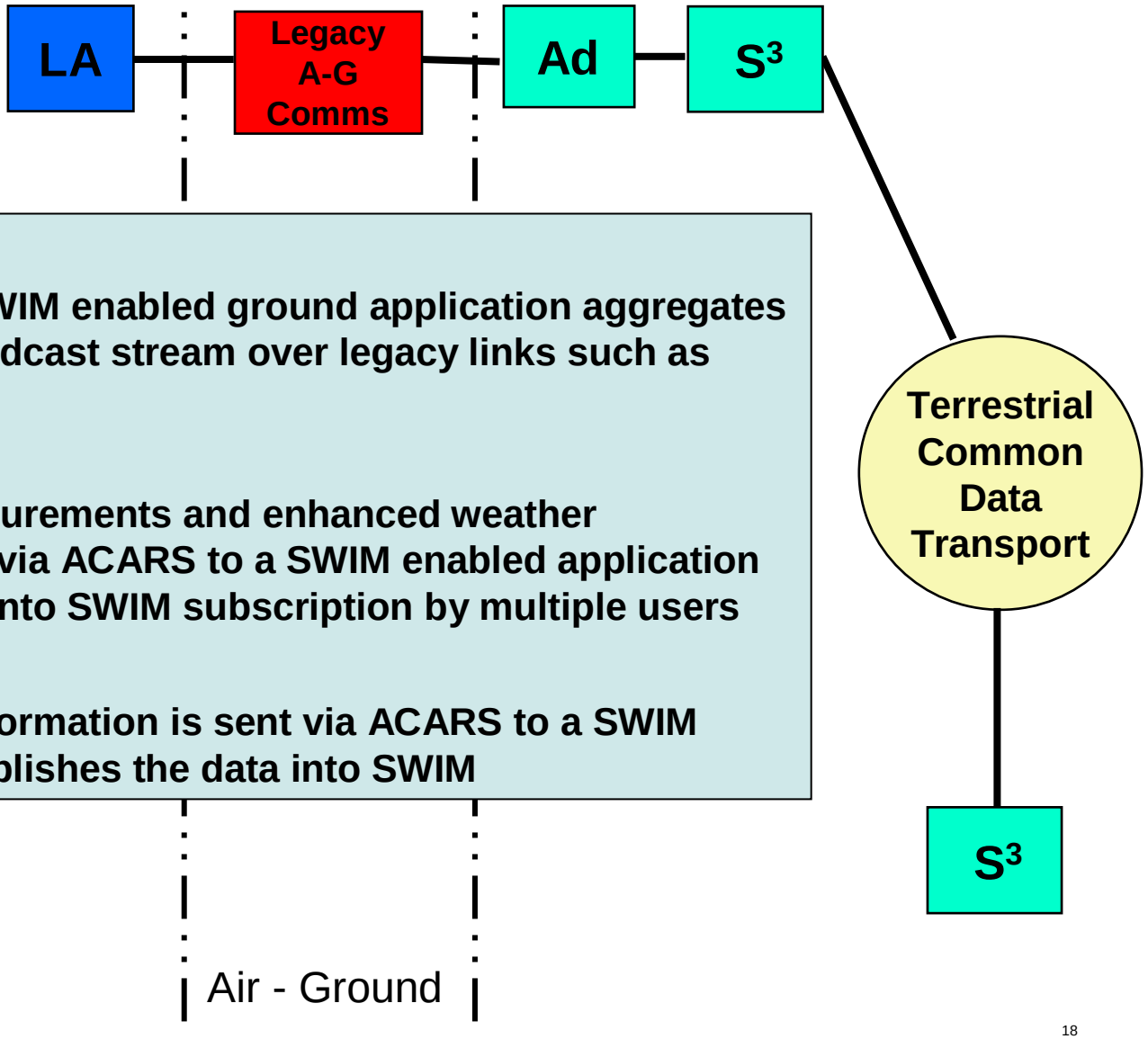
- **Mobile Communications Network Architecture (MCNA) views the aircraft as both an important consumer and producer of information**
- **A network-based communications architecture can enhance the benefits of SWIM and Network Centric Operations in the NAS**
- **The MCNA encompasses both existing air-ground communications as well future data communications links and systems**
- **Through co-funding from NASA GRC and the FAA, the Boeing-led team is developing the plan for future MCNA investments**

Questions



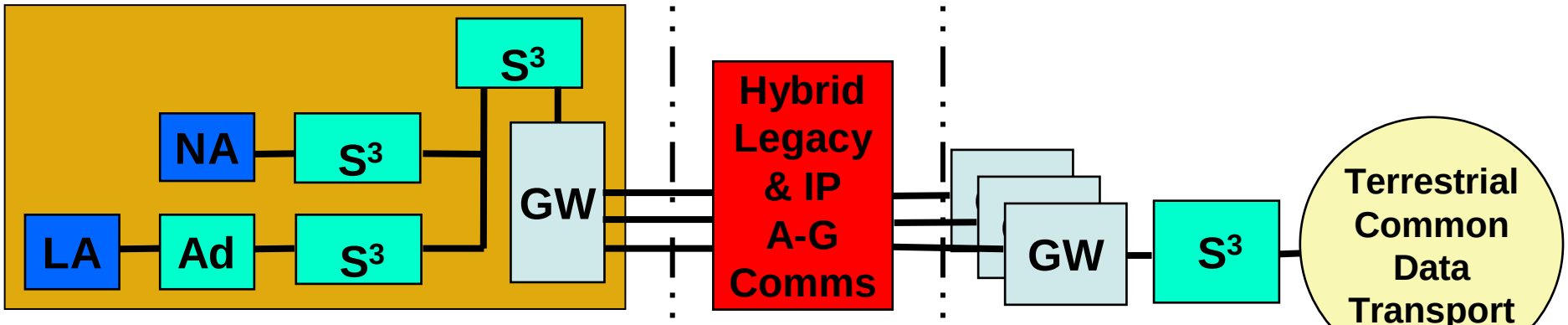
Backup Slides

MCNA/SWIM Nodes – Initial Transition



MCNA/SWIM Nodes – Transition

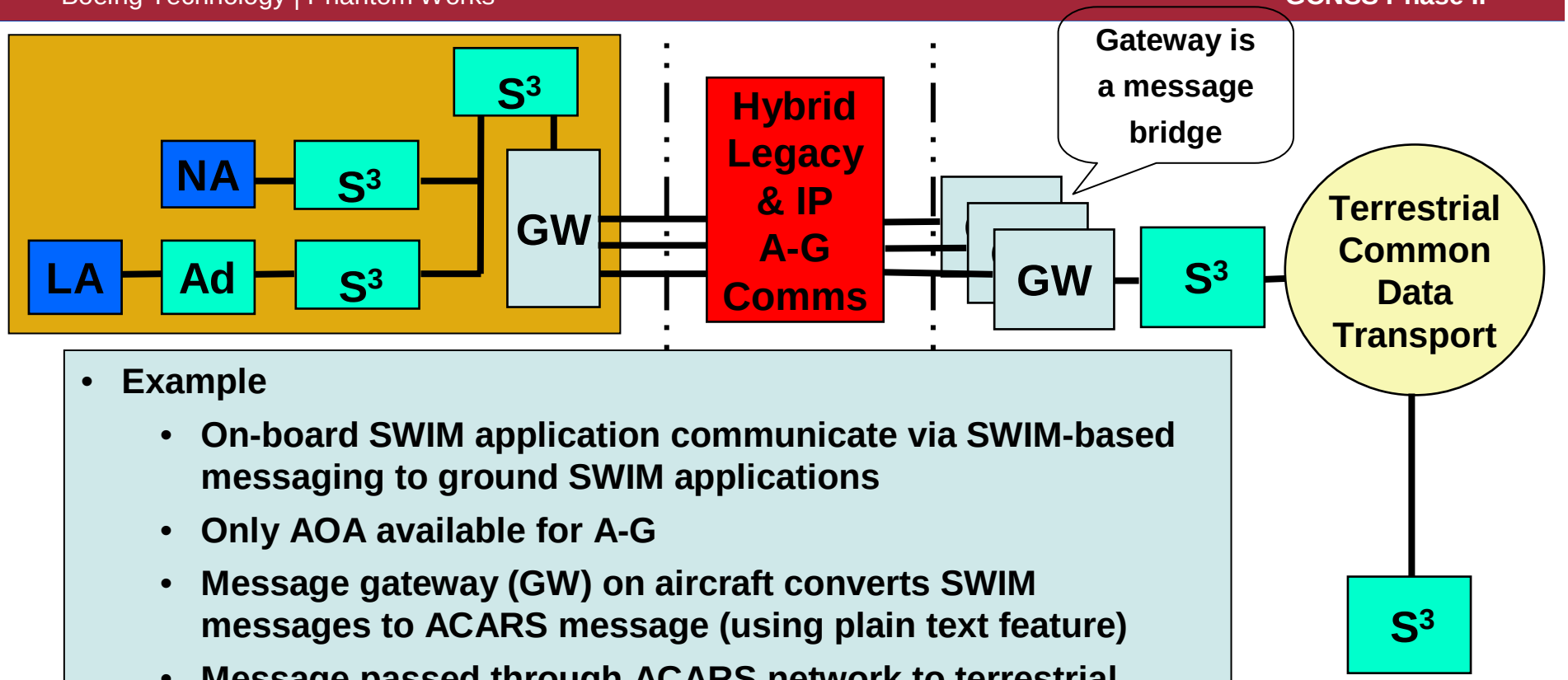
- IP, ATN or ACARS connection from terrestrial CDT to aircraft
- Legacy airplane apps require a SWIM enabled adapter
- New apps can be developed natively SWIM enabled



- On-board SWIM broker provides additional capabilities to minimize unnecessary usage of A-G resources
  - Information caching
  - Local registry of SWIM service available on the aircraft
- Adapters at the air and ground might provide: compression, tunneling, protocol conversion, etc.

Airplane | Air - Ground

MCNA/SWIM Nodes – Transition (continued)



- **Example**
  - **On-board SWIM application communicate via SWIM-based messaging to ground SWIM applications**
  - **Only AOA available for A-G**
  - **Message gateway (GW) on aircraft converts SWIM messages to ACARS message (using plain text feature)**
  - **Message passed through ACARS network to terrestrial message gateway**
  - **SWIM message extracted from ACARS message and forwarded into SWIM**
  - **Response message follows the inverse path**

Airplane | Air - Ground |

MCNA/SWIM Nodes – Vision State

- IP connection from terrestrial CDT to aircraft
- IP A-G is an extension of CDT
- Legacy airplane apps require a SWIM enabled adapter
- New apps can be developed natively SWIM enabled
- On-board SWIM broker provides additional capabilities to minimize unnecessary usage of A-G resources
  - Information caching
  - Local registry of SWIM service available on the aircraft
  - Message router